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# ORIGINAL

# RELATIONSHIP BETWEEN PHYSICAL SELF-CONCEPT AND PHYSICAL ACTIVITY AMONG ADOLESCENTS

# RELACIONES ENTRE EL AUTOCONCEPTO FÍSICO Y LA ACTIVIDAD FÍSICO-DEPORTIVA ADOLESCENTE

**Revuelta, L.[1]; Esnaola, I.[2] and Goñi, A.[3]**

[1] Senior lecturer. Faculty of Philosophy and Educational Science (UPV/EHU) (Spain) lorena.revuelta@ehu.es,
[2] Associate lecturer. Faculty of Philosophy and Educational Science (UPV/EHU) (Spain) igor.esnaola@ehu.es,
[3] Professor. Faculty of Philosophy and Educational Science (UPV/EHU) (Spain) aralfredo@euskalnet.net

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**Spanish-English translator:** Diana Drapper ddraper@arrakis.es

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## ABSTRACT

The aim of this study is to test two opposing models of the relationship between physical self-perceptions and physical activity during adolescence: one which postulates that physical activity influences physical self-concept, and another one which proposes that physical self-concept influences physical activity. Participants were 704 students aged between 11 and 19 (M = 14.91; SD = 2.13) from two different Autonomous Regions in Spain (Cantabria and the Basque

Country). 394 (55.96%) were male and 310 (44.04%) were female. The results indicate that the influences between physical self-concept and physical activity are bidirectional in nature, although the model that proposes physical self-concept as an influencing factor was found to have a better fitness. Differences were found in the model between male and female students. Furthermore, self-perception of *physical attractiveness* was found to be negatively related to physical activity.

**KEY WORDS:** Physical self-concept, physical activity, adolescence

## RESUMEN

El objetivo de este estudio es someter a prueba dos modelos contrapuestos sobre las relaciones entre las autopercepciones físicas y la actividad físico-deportiva en la adolescencia: mientras que un modelo postula la influencia de la actividad física sobre el autoconcepto físico, el modelo alternativo propone al autoconcepto físico como factor influyente en la actividad físico-deportiva. Participan en la investigación 704 estudiantes, 394 (55.96 %) hombres y 310 (44.04 %) mujeres entre 11 y 19 años (*M* = 14.91; *D.T.* = 2.13), residentes en dos Comunidades Autónomas (Cantabria y País Vasco) de España. Los resultados indican que las influencias entre el autoconcepto físico y la actividad físico-deportiva se producen de forma bidireccional si bien ajusta mejor el modelo que propone al autoconcepto físico como factor influyente. Se comprueban diferencias entre hombres y mujeres en el modelo. Por otro lado, la autopercepción de *atractivo físico* mantiene una relación negativa con la actividad físico-deportiva.

**PALABRAS CLAVE:** Autoconcepto físico, actividad física, adolescencia

## INTRODUCTION

Adolescence is a period characterised by a decrease in physical-sporting activity, especially among girls (Haugen, Sáfvenbom, and Ommundsen, 2011; Inchley, Kirby, and Currie, 2011). This is a source of social concern, given the physical and mental health benefits associated with this type of activity (Biddle, Fox, and Boutcher, 2000; Lindwall and Martin, 2006). Consequently, it is important to identify, as precisely as possible, the factors associated with physical-sporting activity during adolescence (Fernández-Río, Méndez-Giménez, Cecchini, and González de Mesa, 2012). One of these factors is self-concept, and, more specifically, physical self-concept.

Physical self-concept is one of the principal domains of general self-concept, within a hierarchical and multidimensional conception of this construct (Shavelson, Hubner, and Stanton, 1976), and is itself divided into four dimensions or sub-domains (Fox and Corbin, 1989; Infante and Goñi, 2009): *physical ability, physical fitness, physical attractiveness* and *physical strength.*

This conception of self-concept demands that its relationships with other variables, such as physical activity, be approached not from a global perspective, but rather separately for each of the dimensions which together make up each of its domains (Hagger, Ashford, and Stambulova, 1998; Rodríguez, Droguett, and Revuelta, 2012), in this case, the dimensions of physical self-concept.

The evidence provided by prior research indicates that, in general, those who regularly engage in some kind of physical activity tend to have a better self-concept, particularly as regards their *physical ability* and *physical fitness*, than those who do so less frequently (Biddle, Whitehead, O'Donovan, and Nevill, 2005; Contreras, Fernández, García, Palou, and Ponseti, 2010). The perception of one's own *physical appearance*, however, is less closely linked to the frequency of physical activity (Fox and Corbin, 1989), although some studies have found a positive association between regular physical activity and self-perceived *physical attractiveness* (Daley, 2002; Haugen et al., 2011; Klomsten, Skaalvik, and Espnes, 2004).

The data relating to sex are inconclusive. Studies with all male participants have found that men who engage in physical-sporting activity have a better perception of their *fitness* and *strength* (Raustorp, Stahle, Gudasic, Kinnunen, and Mattsson, 2005), as well as their *sporting ability, attractiveness, fitness, strength* and *general physical self-concept* (Altintas and Asci, 2008; Fernández, Contreras, García, and González-Villora, 2010). Studies focusing exclusively on women have found that those who engage in physical-sporting activity have a better perception of their *fitness* (Knowles, Niven, Fawkner, and Henretty, 2009), *sporting ability* and *fitness* (Fernández et al., 2010), a better *physical self-concept* and perception of their *appearance* (Biddle and Amstrong, 1992; Douthitt, 1994), as well as a better self-perception of their *strength* and *attractiveness* (Raustorp et al., 2005), *sporting ability*, *fitness* and *strength* and a better *general physical self-concep*t (Altintas and Asci, 2008).

Nevertheless, the positive relationship found between physical-sporting activity and physical self-concept is not always confirmed (Dosil and Díaz, 2002; Schneider, Fridlund, and Cooper, 2008), and some studies have even observed worse physical self-perceptions of one's *ability* and *attractiveness* in cases of overtraining (Morgan and O'Connor, 1988) and dancers (Bakker, 1988), as well as lower scores in self-perceived *physical attractiveness* associated with fitness activities (Camacho, Fernández, and Rodríguez, 2006). Also, engagement in activities related to body cult appear to be associated (particularly among girls) with worse perceptions of one's own *physical appearance* (Fernández et al., 2010).

As regards the relationship between physical self-concept and physical-sporting activity, alongside the role of each of the dimensions, another question that continues to generate debate is the directionality of this relationship. In this sense, the most widespread theoretical assumption holds that an improvement in physical self-concept is one of the benefits that can be attributed to physical

activity, although in accordance with motivational theories (Biddle, 1997; Standage, Gillison, Ntoumanis, and Treasure, 2012) or Harter's competence theory (1978), it can also be held that good self-perception of one's competence encourages more physical-sporting activity. Also, although in this case taking the academic domain of self-concept as our reference, the *reciprocal effects model* (REM; Marsh, 1990; 1993; Marsh, Byrne, and Yeung, 1999; Marsh and Craven, 1997) establishes the dynamic and reciprocal nature of the influence between the different dimensions of self-concept and sporting performance, and is currently a broadly accepted theoretical perspective.

Nevertheless, the majority of the studies cited above use correlational analyses and/or analyses of variance (Altintas and Asci, 2008; Fridlund et al., 2003; Gilson, Cooke, and Mahoney, 2005; Malete, Sullivan, and Matthies, 2008), and do not, therefore, enable cause-effect relationships to be derived from the results. In other words, it is not possible to conclude whether physical activity leads to better physical self-concept, whether better physical self-perception encourages more physical activity, or whether the relationship between the two variables is bidirectional in nature. Furthermore, research based on structural equation analyses (used to verify causal relations in non-experimental data) supports both directions of causality.

One study conducted with Canadian adolescents (Crocker, Eklund and Kowalski; 2000) defends the theory that the dimensions of physical self-concept mediate the influence of physical self-concept on physical activity, with the influence of one's perception of one's *physical fitness* and *sporting ability* being particularly important and explaining 27% and 29% of the variance in physical activity (respectively). Also, in a Finnish context (Jaakola and Washington, 2011), one's perception of one's *physical fitness* was found to explain 33% of the variance in physical activity. On the other hand, a study carried out in Norway (Haugen et al., 2011) found that the level of physical activity engaged in had a significant effect on one's self-perception of one's *appearance* and *athletic competence*, as well as on *general physical self-concept*; physical activity was found not only to have a direct influence on *general physical self-concept* but an indirect one also, through one's perception of one's *athletic competence* and personal *physical appearance*.

A number of research studies that use multiple regression analyses have also verified the influence of self-concept on physical activity. In a sample of Norwegian adolescents (Raustorp et al., 2005), *physical self-perceptions* were found to predict 20% of activity in boys, although only 4% in girls. In Scotland, two studies (Inchley et al., 2011; Knowles et al., 2009) verified that women's self-perception of their *physical fitness* and men's self-perception of their *athletic competence* predicted their physical activity. Finally, in a study carried out in Estonia (Raudsepp, Liblik, and Hannus, 2002), self-perception of *athletic competence* and *strength*, as well as *general physical self-concept,* were found to explain 21% of the variance observed in men's physical activity, while self-perception of *athletic competence* and *attractiveness*, as well as *general*

*physical self-concept* explained 14% of the variance observed in women's physical activity.

Studies focusing on physical-sporting activity programmes which analyse their influence on physical self-perceptions have also provided interesting information, verifying the influence of physical-sporting activity on the sub-domains *athletic competence, physical fitness* and *strength* among American adolescents (Daley and Buchanan, 1999), and on the self-perception of one's *attractiveness* and *physical self-concept* among British adolescents (Burguess, Grogan, and Burwitz, 2006).

In short, it can be concluded that prior research provides diverse empirical evidence regarding the directionality of the influence of physical activity on physical self-concept, and that of physical self-perceptions on physical activity. Despite a number of unanswered questions, the evidence supports the current tendency to acknowledge the bidirectional nature of the relationship between self-concept and physical-sporting activity (Chanal, Marsh, Sarrazin, and Bois, 2005; Marsh and Craven, 2005; Marsh and Perri, 2005; Trautwein, Gerlach, and Lüdtke, 2008). Nevertheless, the diversity of procedures and measurement instruments used, coupled with the partial analyses of these relations makes it difficult to integrate all the available information, and requires the development and verification of models that compare both hypotheses regarding the directionality of the relationship between these variables.

In light of the above, the aim of this study is to contrast an explanatory model of physical self-perceptions based on physical-sporting activity, with another model with an inverse proposed direction of influence (i.e. from physical self-concept to physical-sporting activity). In specific terms, the aim is to clarify both the directionality of the relationship and the specific role played by each of the dimensions of physical self-concept (*physical ability, physical fitness, physical attractiveness* and *physical strength*). Similarly, bearing in mind the differences observed between men and women in relation to both physical self-perceptions (Altintas and Asci, 2008; Esnaola, 2009; Welk and Eklund, 2005) and physical-sporting activity itself (Crocker et al., 2006; Haugen et al., 2011; Inchley et al., 2011), the study also aims to analyse the two models from the perspective of the sex variable.

## MATERIAL AND METHOD

### *Participants*

704 adolescents participated in the study, 394 (55.96 %) boys and 310 (44.04 %) girls, all aged between 11 and 19 ($M$ = 14.91; $SD$ = 2.13). The sampling method used was incidental and relied on collaborators. It was carried out at public and private secondary schools and university faculties in the Spanish Autonomous Regions of Cantabria and the Basque Country. Of the 752 initial participants, 48 (6.38%) were eliminated for failing to correctly complete the

questionnaires, for exceeding the upper age limit established or in order to delete outliers.

*Variables and instruments*

Participants completed the instruments described below, the contents of which form part of a broader study.

To measure *physical self-concept* we used the *Physical Self-concept Questionnaire* (PSQ) by Goñi, Ruiz de Azúa and Rodríguez (2006). This instrument consists of 36 items drafted in the form of positive and negative statements ("I am stronger than the majority of people my age", "I do not have the qualities required for sport") and divided into two general scales (*general physical self-concept* and *general self-concept*) and four specific scales for each of the dimensions of physical self-concept (*physical ability, physical fitness, physical attractiveness* and *physical strength*), which were used in this study as indicators of the latent variable *general physical self-concept*. The responses to the questionnaire are given on a five-point Likert-type scale, where 1 = false and 5 = true. The authors themselves give a global reliability value (Cronbach's alpha) for the questionnaire of α = 0.92, as well as individual values for each of the four scales: *physical ability*, *α* = 0.84; *physical fitness*, *α* = 0.88; *physical attractiveness*, *α* = 0.87 and *physical strength*, *α* = 0.83.

The perceived physical-sporting activity of adolescents was measured using a brief questionnaire created *ad hoc*, which included the variables described below. In order only to register voluntary activities which were the result of personal choice and motivation, participants were asked to respond only in relation to activities carried out during their free time.

- *Frequency* of physical-sporting activities, with three categories: a) Low: when physical-sporting activities are carried out sporadically or just once a week; b) Medium: when physical-sporting activities are carried out between two and three times a week; and c) High: when physical-sporting activities are carried out four or more times a week.

- *Duration of the sessions* or time spent engaged in physical-sporting activity in each session: a) between 1 and 45 minutes; and b) between 46 and 90 minutes or more.

- *Self-perceived intensity of the activity*, associated with respiratory rate, with three levels: a) Gentle: no trouble maintaining respiratory rate; b) Medium: some of the exercises carried out make it hard to maintain respiratory rate; and c) Vigorous: some exercises induce a very high respiratory rate.

*Procedure*

Participating schools were contacted through their respective head teachers and/or directors of study, who were asked to give their consent and authorisation for the study to be carried out. Furthermore, given the age of some of the participants, parental/legal guardian's consent and authorisation was also requested. Once this had been obtained, the questionnaire was administered to each group or class in 45-minute sessions.

With the aim of reducing the social desirability bias and ensuring the veracity of the responses, participation was strictly voluntary and respondents were assured of the completely anonymous processing of the data obtained. Furthermore, the single blind criterion was followed, thus preventing participants from knowing the aim of the research study being carried out.

*Statistical analyses*

This study tests two MIMIC (multiple indicators, multiple causes) models with the aim of analysing the directionality of the relationship between physical self-concept and physical-sporting activity. MIMIC models are a particular type of structural model which aim to verify the influence of a set of observable variables, which make up the structural part of the model, on a latent variable, defined as a composition of another set of observable variables or indicators, which together form the measurement part.

The first of these models holds that physical-sporting activity determines the physical self-concept of adolescents. The observable variables *physical ability, physical fitness, physical attractiveness* and *physical strength* were incorporated into the measurement model as indicators of the latent variable *general physical self-concept* (GPS), while the observable variables *frequency of activity, duration of the sessions* and *self-perceived intensity of the activity* were incorporated as determining factors within the structural model. The alternative model proposes that it is physical self-concept which determines physical-sporting activity. In this case, the observable variables *frequency of activity, duration of the sessions* and *self-perceived intensity of the activity* were incorporated into the measurement model as indicators of the latent variable *physical-sporting activity* (PSA), while *physical ability, physical fitness, physical attractiveness* and *physical strength* were incorporated as determining factors.

The invariance of the proposed models was also analysed in accordance with the sex variable (boy/girl), using a number of multi-group confirmatory factor analyses (MGCFAs).

The maximum likelihood method was used to estimate the models. This procedure assumes the suppositions of multivariate normal distribution of the data, which is why, prior to estimating the models, the multiple imputation for missing data (1%) method was applied, and outliers were analysed and

eliminated, taking the Mahalanobis distance and the normalisation of the resulting base as references. With the exception of the analysis of outliers, which was carried out using the SAS 9.1 programme, all analyses were conducted using the LISREL 8.8 statistical software package.

## RESULTS

To interpret the goodness of fit of the models, the results of which are presented below, the chi squared / degrees of freedom ratio ($\chi^2$/df) was used in order to reduce the sensitivity of the model to the sample size. Values lower than 3 on this indicator denote a satisfactory fit between the model and the empirical data (Kline, 1998). As absolute goodness of fit indexes, we used the Goodness of Fit Index (GFI), with values of over 0.90 indicating good fit (Byrne, 2001), and the Root Mean Square Error Approximation (RMSEA) index, in which values equal to or lower than 0.05 indicate good fit and those of up to 0.08 indicate a reasonable explanation of the cases (Browne, and Cudeck, 1993). Finally, as incremental fit indexes (i.e. those that compare the function of the fit of the null model with that of the proposed model), we used the Non-Normed Fit Index (NNFI) and the Comparative Fit Index (CFI). In both these indexes, values of above 0.90 are considered acceptable (Byrne, 2001).

The validity and reliability of the observable variables or indicators of each of the latent variables were also analysed, along with their composite reliability and the magnitude and nature (positive or negative) of the coefficients of the observed relationships of influence.

### Influence of physical-sporting activity on general physical self-concept

Upon analysing the different goodness of fit indexes together in order to determine the degree to which the model fits the empirical data, since no index alone is enough to determine this circumstance, the model's goodness of fit was found to be adequate in all three samples analysed: total ($\chi^2/df$ = 3.9; *RMSEA* = 0.064; *NNFI* = 0.94; *CFI* = 0.97; *GFI* = 0.98), boys ($\chi^2/df$ = 2.41; *RMSEA* = 0.060; *NNFI* = 0.94; *CFI* = 0.97; *GFI* = 0.98) and girls ($\chi^2/df$ = 2.44; *RMSEA* = 0.067; *NNFI* = 0.93; *CFI* = 0.95; *GFI* = 0.98). With the exception of the chi squared index in relation to the model corresponding to the global sample group, which was slightly high, adequate values were found in all other indexes of fit.

As regards the measurement component, Table 1 shows the results corresponding to the analysis of the observable variables or indicators of the latent variable *general physical self-concept*.

**Table 1**. Indicators of the Latent Variable General Physical Self-concept

| Observable variable | | Sample groups | | |
|---|---|---|---|---|
| | | Total | Boys | Girls |
| Physical ability | Saturation | 0.83** | 0.83** | 0.86** |
| | $R^2$ | 0.70 | 0.68 | 0.74 |
| Physical fitness | Saturation | 0.69** | 0.71** | 0.58** |
| | $R^2$ | 0.48 | 0.50 | 0.33 |
| Physical attractiveness | Saturation | 0.54** | 0.66** | 0.35** |
| | $R^2$ | 0.30 | 0.43 | 0.12 |
| Physical strength | Saturation | 0.50** | 0.39** | 0.51** |
| | $R^2$ | 0.25 | 0.15 | 0.26 |

** $p < 0.001$

In all three groups analysed, the results indicate that the observable variables *physical ability, physical fitness, physical attractiveness* and *physical strength* explain a significant percentage of the variance of the latent variable *general physical self-concept*. The $R^2$ values were located within the 0.68-0.74 range for *physical ability,* 0.33-0.50 for *physical fitness*, 0.12-0.43 for *physical attractiveness* and 0.15-0.26 for *physical strength*, which confirms the validity of the selected indicators. Also, all the factor saturations are reasonably high with *p* values lower than 0.001, thus indicating a strong association between these observable variables and their corresponding latent variable, which is appropriately measured by the selected indicators. These results confirm the conceptualisation of the variable *general physical self-concept* as a valid latent construct.

As regards the composite reliability of the latent variable general physical self-concept, the $\rho$ value was above 0.60 in all three study groups: total ($\rho$ = 0.74), boys ($\rho$ = 0.68) and girls ($\rho$ = 0.67). We can thus conclude that the indicators of the variable are a reliable measure of the construct.

As regards the structural component, the standardised coefficients indicate changes in the corresponding latent variable, in terms of standard deviation, derived from each standard deviation in the predictor variables. The results are presented in Table 2.

**Table 2.** Influence of Physical-Sporting Activity on General Physical Self-concept

| Relationship | | Sample groups | | |
|---|---|---|---|---|
| | | Total | Boys | Girls |
| Frequency of activity → GPS | Coefficient | 0.22** | 0.14* | 0.23** |
| | Standard error | 0.04 | 0.05 | 0.06 |
| Duration of the sessions → GPS | Coefficient | 0.08* | 0.06 | 0.05 |
| | Standard error | 0.04 | 0.05 | 0.06 |
| Self-perceived intensity → GPS | Coefficient | 0.19** | 0.17** | 0.17** |
| | Standard error | 0.04 | 0.05 | 0.06 |

*$p < 0.05$ **$p < 0.001$*

In the total sample group, the structural model reveals the three observable variables *frequency of activity, duration of the sessions* and *self-perceived intensity* to be positive and statistically significant determining factors ($p < 0.05$) of *general physical self-concept*. Thus, in the total sample of adolescents, the higher the weekly frequency, the greater the intensity of the activity and the longer the duration of the sessions, the more positive the physical self-perception.

In the samples of male and female participants, however, it is only *frequency of activity* and *self-perceived intensity*, not *duration of the sessions*, that predict both positively and with statistical significance ($p < 0.05$) *general physical self-concept* among adolescents.

The structural equation indicates that, in total, 14%, 7% and 12% of the variance of the variable *general physical self-concept* in the total, male and female samples is explained by the proposed MIMIC model.

**Influence of general physical self-concept on physical-sporting activity**

In relation to the results for the influence of physical self-concept on the physical-sporting activity of adolescents, the fit of the MIMIC model can be considered adequate in all three cases analysed: total ($\chi^2/df$ = 0,90; *RMSEA* = 0.002; *NNFI* = 0.99; *CFI* = 1.00; *GFI* = 0.99), boys ($\chi^2/df$ = 1,01; *RMSEA* = 0.005; *NNFI* = 1.00; *CFI* = 1.00; *GFI* = 0.99) and girls ($\chi^2/df$ = 2.91; *RMSEA* = 0.073; *NNFI* = 0.91; *CFI* = 0.97; *GFI* = 0.98), since in all cases the total for the indicators used is within the range considered acceptable.

As regards the measurement component, Table 3 shows the results corresponding to the analysis of the observable variables or indicators of the latent variable *physical-sporting activity*.

**Table 3.** *Indicators of the Latent Variable Physical-Sporting Activity*

| Observable variable | | Sample groups Total | Boys | Girls |
|---|---|---|---|---|
| Frequency of activity | Saturation | 0.60** | 0.57** | 0.66** |
| | $R^2$ | 0.41 | 0.32 | 0.44 |
| Duration: of the sessions | Saturation | 0.57** | 0.48** | 0.55** |
| | $R^2$ | 0.33 | 0.23 | 0.30 |
| Self-perceived intensity | Saturation | 0.64** | 0.58** | 0.66** |
| | $R^2$ | 0.41 | 0.33 | 0.44 |

** $p < 0.001$

The results show that the observable variables *frequency of activity, duration of the sessions* and *self-perceived intensity* explain, in the total, male and female sample groups, a significant percentage of the variance of the corresponding latent variable. The $R^2$ values oscillate between 0.32 and 0.44 for *frequency of activity,* between 0.23 and 0.33 for *duration of the sessions* and between 0.33 and 0.44 for *self-perceived intensity*, and confirm the validity of the indicators. The factor saturations are high and indicate a strong relationship between the selected observable variables and the latent variable *physical-sporting activity* ($p < 0.001$), which is adequately measured by the selected indicators, thus confirming the validity of the construct.

For their part, the $\rho$ values were over 0.60 in both the total sample group ($\rho$ = 0.64) and male ($\rho$ = 0.60) and female groups ($\rho$ = 0.65), and confirm the composite reliability of the latent variable.

The analysis of the model's structural component is shown in Table 4.

**Table 4.** Influence of Physical Self-concept on Physical-Sporting Activity

| Relationship | | | Sample groups Total | Boys | Girls |
|---|---|---|---|---|---|
| Physical ability → | PSA | Coefficient | 0.17** | 0.13 | 0.22** |
| | | Standard error | 0.05 | 0.08 | 0.08 |
| Physical fitness → | PSA | Coefficient | 0.38** | 0.40** | 0.29** |
| | | Standard error | 0.05 | 0.08 | 0.07 |
| Physical attractiveness → PSA | | Coefficient | -0.17** | -0.16* | -0.18** |
| | | Standard error | 0.04 | 0.08 | 0.06 |
| Physical strength → | PSA | Coefficient | 0.19** | 0.11 | 0.15* |
| | | Standard error | 0.04 | 0.06 | 0.07 |

*$p < 0.05$ **$p < 0.001$

In the total and female sample groups, the structural equation revealed the four dimensions of physical self-concept to be statistically significant determining factors ($p < 0.05$) of *physical-sporting activity*, three of them positively (*physical*

*ability, physical fitness* and *physical strength*) and one negatively (*physical attractiveness*). It can therefore be affirmed that, in the total and female sample groups, the better the perception of one's physical *ability, fitness* and *strength*, the greater the *frequency, duration* and *intensity* of adolescents' physical-sporting activity, while in the case of *physical attractiveness*, it is more negative perceptions that lead to this same behaviour. In the male sample group, however, only the dimensions *physical fitness* (positively) and *physical attractiveness* (negatively) predict the *physical-sporting activity* of adolescents with statistical significance ($p < 0.05$).

The structural equation indicates that, in total, 29%, 21% and 24% of the variance of the variable *physical-sporting activity* in the total, male and female samples is explained by the proposed MIMIC model.

Finally, the following are the results of the comparison between the two models, for which we used the Expected Cross-Validation Index (ECVI) and its confidence interval. The ECVI offers an approximation of the goodness of fit the estimated model would achieve in another sample of the same size, with lower values indicating better fits (Batista, and Coenders, 2000). Furthermore, when the ECVI of one model is outside the confidence interval of the model to which it is being compared, it can be affirmed that both models are significantly different (Goñi, Rodríguez and Esnaola, 2010).

As regards the total sample group, the model of the influence of physical-sporting activity on physical self-concept (model 1 in this study) was found to have an ECVI of 0.11 (0.086-0.14). The model of the influence of physical self-concept on physical-sporting activity (model 2 in this study) had a value of 0.068 (0.068-0.082). We can therefore state that both models are significantly different, since the ECVI values for each are outside the confidence interval of the other, and it is model 2 that shows the best fit.

Similar results were found for the male sample. Models 1 and 2 had ECVI values of 0.15 (0.13-0.20) and 0.12 (0.12-0.15) (respectively), which enables us to confirm that model 2 has a better fit and that both models are significantly different.

As regards the female sample, on the other hand, model 1 was found to have the lower ECVI value, 0.20 (0.16-0.26) as opposed to 0.21 (0.17-0.26) for model 2. However, in this case, both models can be considered equivalent since the ECVI values are located within each other's confidence interval.

**Analysis of invariance**

The results of the MGCFAs are presented in Table 5. In addition to the indexes outlined above, we also used the increment of the ΔCFI index as an indicator of the fit of the different nested models, with an invariance index value of less than

0.01 being considered indicative of a less restrictive model (Cheung and Rensvold, 2002).

**Table 5.** Goodness of fit indexes for the Invariance Models

| **Configural invariance model (20 df/13df)** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | *n* | $\chi^2$ | *P* | RMSEA | NNFI | CFI | GFI | SRMR |
| Model 1 | 704 | 53.78 | .000 | .06 | .91 | .95 | .97 | .04 |
| Model 2 | 704 | 15.09 | .030 | .02 | .99 | .99 | .99 | .02 |
| **Measurement invariance model (25 df/18df)** | | | | | | | | |
| | *n* | $\chi^2$ | *P* | RMSEA | NNFI | CFI | GFI | SRMR | ΔCFI |
| Model 1 | 704 | 67.56 | .000 | .06 | .91 | .94 | .96 | .06 | -.01 |
| Model 2 | 704 | 20.31 | .031 | .01 | .99 | .99 | .98 | .03 | .01 |

The configural invariance model is the first step required for checking invariance and implies the equivalence of the model's basic structure for all the sample groups tested, indicating that participants in these groups all conceptualise the different constructs in the same way. The goodness of fit indexes obtained (Table 5) support the hypothesis of the basic model's invariance in accordance with the sex variable in the two proposed MIMIC models, since although the chi squared index is statistically significant in both cases, all the other indexes were found to have values located within accepted parameters.

The second step consists of verifying the measurement invariance model. In addition to the equivalence of the structure, this also implies correspondence between item saturations on the corresponding factor in the different sample groups being tested. In other words, it indicates whether or not the different groups respond to the proposed items in the same way. The values presented in Table 5 support this type of invariance in both cases (model 1 and model 2). The goodness of fit indexes for both models were found to have acceptable values, and only the chi squared index reached the statistical significance level indicative of absence of fit. Moreover, no significant decreases were observed in the CFI index in comparison with the previous models. It can therefore be concluded that the different scores obtained in the different items of the questionnaire indicate inter-group differences in relation to the corresponding construct.

## DISCUSSION

A number of different studies (Altintas and Asci, 2008; Goñi, et al., 2010; Malete et al., 2008) provide evidence of correlations between physical self-perceptions and physical-sporting activity. In relation to the direction of causality between the two variables, although it is widely accepted in numerous academic and educational circles that an improvement in physical self-concept is one of the most important psychological benefits of engaging in physical and sporting activities (Fox, 2000), there is also much empirical support for an inverse direction of causality, according to which, physical self-perceptions influence the

degree of physical activity engaged in, as explained in the introduction to this paper. Consequently, the general trend at present is to accept a reciprocal effect model in which prior physical self-concept determines the physical-sporting behaviour of the subject and, in turn, this activity influences self-perception. Very few studies, however, have confirmed this claim, which is why the aim of this study was to compare both explanatory models of the relationship between physical self-concept and physical-sporting activity in order to determine its magnitude in both directions.

The results indicate that, in accordance with the current theoretical trend (Chanal et al., 2005; Marsh and Craven, 2005; Marsh and Perri, 2005; Trautwein et al., 2008), the relationship between physical self-concept and physical-sporting activity is indeed bidirectional in nature: physical perceptions determine the frequency, duration and intensity of physical-sporting activity, while at the same time, this activity influences physical self-concept. The adequate invariance level of both models in accordance with the sex variable also supports these results.

Furthermore, as regards the role of each of the dimensions of physical self-concept in determining physical-sporting activity, consistently with the findings of several previous studies (Crocker et al., 2000; Inchley et al., 2009; Jaakola and Washington, 20011; Knowles et al., 2009; Raudsepp et al., 2002), the results obtained here indicate a positive influence of *physical ability*, *physical fitness* and *physical strength* on frequency, duration and intensity of the physical-sporting activity. However, they also show that the relationship of influence exercised by *physical attractiveness* is negative, a result which requires special comment.

Prior research has identified *attractiveness* as a positive predictor of physical activity (Raudsepp et al., 2002), as well as the dimension of physical self-concept that is least related to this behaviour (Fox and Corbin, 1989). However, and although further research is required to clarify this, it is logical to conclude that a negative perception of one's own *physical attractiveness* may lead to a greater frequency, duration and intensity of physical-sporting activity; a similar relationship has also been found between a negative perception of one's body image and physical activity (Bakker, 1988; Camacho et al., 2006; Loland, 2000). Given the enormous importance attached to physical appearance in modern-day society, physical-sporting activity constitutes a means of improving one's looks. This would also be consistent with the greater presence of women in activities related to fitness and body cult, and their lower level of participation in other types of physical-sporting activities, in comparison with men.

Finally, bearing in mind the traditionally different behaviour of men and women in relation to self-perceptions (Altintas and Asci, 2008; Esnaola, 2009; Welk and Eklund, 2005) and physical-sporting activity (Crocker et al., 2006; Haugen et al., 2011; Inchley et al., 2011), this study also aimed to analyse sex-related differences in the results presented above. The results of this present study reveal that, while among adolescent girls the four dimensions of physical self-

concept influence physical-sporting activity, among adolescent boys, only *physical fitness* and *physical attractiveness* were found to have this same influence. This is a new empirical contribution to a question about which, as stated in the introduction, much disperse and incohesive information exists.

As regards the influence of physical-sporting activity on physical self-perceptions, the *frequency* and *intensity* of the activity, although not its *duration*, were found to be determining factors for both male and female adolescents. This result is consistent with the identification of a less intense relationship between the duration of the activity and physical self-perceptions than between the frequency and intensity of the activity and physical self-perceptions (Infante and Zulaika, 2008), possibly due to the fact that duration is a variable generally established by the organisers of the activity, and is therefore more independent of the interests and motivations, etc. of the subject than frequency or intensity.

Another interesting aspect that was verified by our results is that, in the female sample, the direct and inverse relationships between physical self-concept and physical-sporting activity are equivalent, whereas for boys, the one from self-concept to activity is stronger than its inverse counterpart. One possible explanation of this may be that the socio-cultural context is often more favourable to the development of boys' physical self-concept and self-confidence for sporting performance than of girls' (Jacobs, Lanza, Osgood, Eccles, and Wigfield, 2002); consequently, the benefit of physical-sporting activity for improving physical self-perceptions is greater for girls.

The study also has certain limitations which need to be clarified. Firstly, the use of a subjective method for measuring physical-sporting activity means that the results should be interpreted with a certain degree of caution. Although the use of this type of measure (which was used here for practical reasons) is widely accepted (Dishman, Washburn, and Schoeller, 2001), recent studies have found diverse discrepancies between indirect and direct measures of physical-sporting activity in children and adolescents (Adamo, Prince, Tricco, Connor-Gorber, and Tremblay, 2009). This must be taken into consideration and it should be remembered at all times that our study analyses the relationship between physical self-concept and *perceived* physical-sporting activity. Finally, the incidental nature of the sample group is another important constraint, since it limits the degree to which the results can be generalised to the broader adolescent population.

Despite this, however, the results obtained may have important implications as regards the implementation of educational programmes in the field of Physical-Sporting Education and Health. Although it is only logical to expect an improvement in physical self-concept as the result of encouraging physical activity, evidence suggesting that cognitive programmes designed to improve physical self-concept may have an even greater influence on increasing physical activity is something which should, without doubt, be taken into consideration. This leads us to recommend that traditional programmes focused

solely on increasing exercise levels be abandoned in favour of those interventions that seek to influence both aspects simultaneously.

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